ATSS-A

PRESS KIT

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546
TELS. WO 2-4155
WO 3-6925

FOR RELEASE: TUESDAY P.M.
November 16, 1965

RELEASE NO: 65-352

PROJECT: IQSY Satellite

CONTENTS

TO BE LAUNCHED NO EARLIER THAN NOVEMBER 18

(NASA-News-Release-65-352) NASA, NAVAL LABORATORY TO LAUNCH IQSY SOLAR EXPLORER (NASA) 22 p Avail: NASA Scientific and Technical Inf

N76-71721

Unclas
00/98 09734

NEWS NASA
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546
TELS. WO 2-4155
WO 3-6925

FOR RELEASE: TUESDAY P.M.
November 16, 1965

RELEASE NO: 65-352

NASA, NAVAL LAB TO LAUNCH IQSY SOLAR EXPLORER

The National Aeronautics and Space Administration and the Naval Research Laboratory will launch no earlier than Nov. 18 a satellite to measure and monitor solar x-ray emissions during the final portion of the 1964-65 International Quiet Sun Year (IQSY).

The IQSY Solar Explorer, developed by NRL, will be launched from NASA's Wallops Station, Wallops Island, Va., on a four-stage Scout.

The international scientific community has been invited to acquire data directly from the satellite. Information obtained will be correlated internationally by scientists conducting studies related to IQSY, a period when solar activity is at a minimum.

The IQSY Solar Explorer, by measuring and monitoring solar X-ray emissions and providing immediate data to interested scientists, has the potential for improving forecasts of ionospheric conditions that affect short-wave radio communications and for developing a warning system for major solar flares which produce intense proton emissions hazardous to manned activities in space.

-more-

11/12/65

The 125-pound spacecraft consists of two 24-inch hemispheres separated by an equatorial band in which are installed 12 photometers for measuring solar X-ray and ultraviolet emissions. Electrical power is supplied by solar cells mounted on the hemispheres.

The spin-stabilized satellite will be placed into a 430-by-630 mile orbit inclined 60 degrees to the Equator. Expected active lifetime is one year.

The spacecraft will complement and continue the scientific missions of other NASA spacecraft and the NRL's two Solar Radiation (SOLRAD) satellites: 1964-01D, launched in January 1964 and 1965-16D, launched in March 1965.

NASA's Office of Space Science and Applications (OSSA) has overall direction of the IQSY Solar Explorer and Wallops Station is responsible for project coordination and launch operations.

Satellite commands and acquisition of scientific data will be carried out by NRL through its Tracking and Command Station in Hybla Valley, Va.

NASA's Goddard Space Flight Center, Greenbelt, Md., will be responsible for tracking the satellite during its useful life and will support NRL in acquisition of telemetered data from the satellite.

-more-

The Scout launch vehicle is under the management of NASA's Langley Research Center, Hampton, Va.

(Background information follows)

BACKGROUND

The Earth is a body immersed in the atmosphere of a star--the Sun. Radiation from the Sun controls the environment of Earth, of other solar system planets and of interplanetary space. Because most emissions of radiation from the Sun are variable, the environment of the Earth is variable.

These is a pattern to solar activity, with a maximum and a minimum occurring every 11 years, and a similar cyclic variation is evident in the properties of the Earth's atmosphere.

The present period is one of minimum solar activity. The next period of maximum activity will be from 1967 to 1972.

Solar Flare Important

The solar flare appears to be the most important part of the solar activity insofar as effect upon the environment of the Earth is concerned. A flare is a sudden brightening of an area of the solar surface occurring in a few minutes and then slowly decaying over a period of hours.

The X-rays and enhanced ultraviolet light emitted during the life of a flare increase the ionization in the Earth's ionosphere and disrupt short-wave radio communications.

The largest flares also emit great numbers of high energy protons which increase the radiation levels in interplanetary space and over the Earth's poles. Greater knowledge of the radiation emitted by the Sun is required to understand these interactions between solar events and the Earth's upper atmosphere and ionosphere.

In addition to effects on interplanetary space, the Sun itself is an interesting astronomical object. It is the only star whose surface characteristics we can resolve and study. Knowledge gained by studying the Sun will help astrophysicists to understand and interpret the data from other stars.

Value of Space Research

The techniques of space research permit scientists to expand solar studies two ways: They can increase the resolving power of their telescopes through the elimination of atmospheric distortion, and they can observe many more decades (groupings) of the electromagnetic spectrum.

The Sun emits electromagnetic radiation (light, radio and infrared radiation) in 16 decades of wavelength or "color".

Of these 16 decades, only a fraction of one decade is the visible light that a human eye can see. Three other decades lie in the radio portion of the spectrum which can be observed on the ground.

The rest of the solar radiation is absorbed in the Earth's atmosphere and can be observed only with instruments above the atmosphere.

The absorbed portions of the spectrum are doubly important. They are the portions which vary with solar activity. In order to understand the mechanism of a solar flare, studies of the ultraviolet and X-rays emitted during a flare (both of which are absorbed in the atmosphere) must be made. Furthermore, since the radiation is absorbed in the upper atmosphere, these portions of the solar radiation control the nature of the upper atmosphere.

How Satellites Help

Satellites contribute to studies of solar phenomena in three major ways. They make possible the study of the ultraviolet, X-ray and gamma ray radiation which is absorbed in the atmosphere; they permit continuous monitoring of this radiation during solar cycles of activity; and they provide higher resolution than ground equipment through the elimination of atmospheric scattering.

-more-

The primary reason for the solar studies is to meet the overall objective to expand human knowledge of space phenomena. While these are exciting and important reasons for the work there are also practical benefits to be gained.

Knowledge of solar radiation and its effects on the terrestrial environment, together with continuous monitoring of the entire spectrum of solar radiation, should result in significant advances in the understanding of, and ultimate control over weather.

If significant advance signs of solar activity can be found and used to predict solar flares, this discovery will be a major contribution to the communications industry, meteorology and manned space flights.

Several Techniques Tried

In recent years portions of the solar spectrum of radiations have been observed by ground-based monitors, balloon-borne instruments, high-flying aircraft, sounding rocket flights, deep space probes, and satellites. Scientists from industry, universities, and several Government agencies have engaged in these efforts to unlock the Sun's secrets.

The Naval Research Laboratory began in 1949 a program of observation of solar ultraviolet and X-ray emissions in which the V-2 and, later, Aerobee sounding rockets were used to lift sensitive instruments (spectrographs and photometers) above the absorbing layers of the atmosphere.

In 1956, NRL began trying balloon-launched rockets, ROCKOONS, in a direct-measurement attempt to test the theory that solar X-rays were responsible for sudden ionospheric disturbances (SIDs) during solar flares.

A rocket fired during a solar flare July 20, 1956 indicated a surprisingly high intensity of X-rays between altitudes of 75 and 100 kilometers (47 to 62 statute miles). The X-ray flux was the first ever obtained at such short wavelengths and at such a low level in the ionosphere.

Sounding Rockets Useful

Subsequent ground-launched sounding rockets gathered considerable new data on X-ray emissions during 1957 through 1959. Rocket measurements were made during three solar flares each of which was accompanied by a large SID.

Sounding rocket experience by NRL, NASA and others provided the brief glimpses of the Sun's spectrum necessary to guide development of satellite instrumentation.

In the study of such spasmodic events as solar flares, however, the sounding rockets have three handicaps: They cannot be launched quickly enough to see the early phases of flare; they cannot stay above the Earth's atmosphere long enough to measure time variations of solar X-ray and ultraviolet emissions; and it is difficult to keep instruments pointed at the Sun due to roll and yaw.

Therefore, scientists turned to satellites capable of providing a stable platform for continuous solar monitoring.

In June 1960, the SR-I, designed and built by NRL, became the first successful solar X-ray monitoring satellite. Because X-ray monitoring could be conducted only when SR-I passed over a telemetry station, the experiment depended on NASA for tracking and data acquisition.

SR-I Results Significant

Despite modest capabilities, 577 telemetry records were obtained from SR-I between June 22 and Nov. 1, 1960. One hundred of these showed measurable X-ray fluxes.

Results were significant. SR-I confirmed the hypothesis that solar X-rays cause sudden disturbances in the ionosphere during flares and determined the intensity necessary to trigger the changes.

-more-

It also established that active prominence regions, bright surges on the edge of the Sun, and certain solar-edge (limb) flares have the same characteristics as major disk flares. The disk is the central portion of the Sun as viewed from Earth.

Data from SR-I showed that solar X-ray fluxes provide a very sensitive measure of solar activity and can change significantly within one minute. It was found that long-duration X-ray events of moderate intensity can accompany rising prominences on the solar limb. Prominences are streams of cool gas that surge into the hot corona.

The second satellite in the SR series failed to achieve orbit and the third, SR-III, launched in June 1961, went into a tumbling mode that made data reduction difficult. Nevertheless, some of the data from SR-III has been reduced and found useful.

Variations Disclosed

The experiments of SR-I and SR-III made it evident that X-ray emission spectra vary greatly from one flare to another and with time during a single flare event.

The most successful satellite of the SR series was launched in January 1964 and became 1964-01D. During periods of good alignment relative to the Sun, the satellite has provided 200 minutes per day of direct solar observations with measurements of solar X-ray emissions in the spectrum bands of 1-8, 8-12, and 44-60 angstroms. The angstrom (A) is a tiny measure of wavelength: 3,200 A equals about 13 one millionth of an inch.

The 1964-01D is still operating and its experiment data is being analyzed. The 44-60 A wavelength band has proved especially sensitive to even the smallest solar event and its observed flux has been correlated to plage phenomena. Plages are bright, hot areas that appear on the Sun's photosphere. The photosphere is the visible disk of the Sun.

Since NASA was established in October 1958, there has been a close working relationship between NRL and NASA personnel in numerous scientific projects of mutual interest. Vanguard II, the first satellite launched by NASA (February 1959), was developed by an NRL team that was transferred to NASA.

Among many former NRL scientists and project managers now with NASA in key positions is Dr. Homer E. Newell, Associate Administrator for Space Science and Applications.

Much of the NASA-NRL cooperation and interagency support has been in efforts related to solar physics. In the area of scientific exploration, an understanding of the universe, with particular emphasis on the solar system, remains the all-encompassing NASA objective.

OSOs Have Major Role

A series of Orbiting Solar Observatories has a major role in NASA's solar physics program which is directed at determining and defining the physical processes by which the Sun influences the Earth and its space environment and at advancing knowledge of the Sun's structure and behavior.

The first of eight planned OSOs was launched March 7, 1962 and the 13 scientific experiments on OSO I provided useful data for more than two years. The second, OSO II, was launched Feb. 3, 1965. The third failed to achieve orbit Aug. 25, 1965 .

The OSOs weigh about 600 pounds and are designed primarily as highly stabilized platforms for precision pointing of a large number of solar-oriented instruments.

The IQSY Solar Explorer complements and extends other NASA-sponsored launches which include solar monitoring. Similar NRL experiments on OSO II had nominal lifetimes of about six months and are no longer operative.

The IQSY Solar Explorer is unique in that it can provide real-time (immediate) data acquisition worldwide to anyone who chooses to receive it.

Objectives of IQSY-SE

The IQSY Solar Explorer, designed and built by NRL, will continue the solar X-ray monitoring program begun by SR-I. Main objectives are to:

1. Monitor the Sun's energetic X-ray emission with standardized X-ray photometers;

2. Measure the time history of X-ray emission intensity and spectral equality of solar flare emissions and to correlate these measurements with those of optical and radio ground-based observatories; and

3. Provide real-time solar monitoring information to all interested participants in the IQSY program.

SPACECRAFT DESCRIPTION

The spacecraft consists of two 24-inch diameter hemispheres separated by a $3\frac{1}{2}$ inch equatorial band in which are mounted 12 photometers with magnets to shield the photometers from saturation by Van Allen radiation belt electrons. Also mounted on the equitorial band are four antennas for telemetry purposes.

Six flat circular panels covered with solar cells are mounted symetrically on the hemispheres.

Electric power converted from solar energy by the cells is available to charge the nickel-cadmium batteries and to operate all spacecraft electrical systems. The symetrical arrangement of the 11-inch diameter panels assures adequate power regardless of the Sun angle.

The silicon solar cells will supply six watts of power. The portion of the shell not covered with solar cells is highly polished and has a thermal control coating applied. This will keep the internal temperature between 10 and 40 degrees Centigrade.

Two low-thrust vapor jets are located adjacent to the equatorial band to maintain spin rate and control of the spin axis. The spacecraft is planned to be spin stabilized at about one revolution per second. Two Sun sensors located 180 degrees apart generate properly timed jet pulses to precess the spin axis as necessary.

Output of four photometers can be switched to the low-power Digital Data Storage System (DDSS). The digitized data can be read out over a special transmitter by command when the satellite passes near the NRL ground facility.

Radio equipment on the satellite includes an analog transmitter for continuous operation, a digital transmitter to operate on command only, the four-element antenna system, and two command receivers connected to a decoder system for placing the spacecraft and its experiments in desired operating modes.

The telemetry system consists of six subcarrier oscillators. Their mixed output modulates a transmitter which will send both housekeeping and X-ray data.

A magnetic core memory system will collect data from four X-ray detectors over a 24-hour period and then, on command, transmit the digitized data for five minutes to the NRL ground station. After that the system is reset to collect data for another 24-hour stretch.

SOLAR RADIATION MEASUREMENTS

All radiant energy, including that from the Sun, is emitted in many diverse forms and over a tremendous range of frequencies, or wavelengths. All these forms of radiant energy are electromagnetic in nature, obey the same basic laws and travel through space at the speed of light (about 186,300 miles per second). They differ in wavelength, origin and the ways in which they manifest themselves.

The entire array of electromagnetic radiations is called the electromagnetic spectrum.

Wavelengths corresponding to radio frequencies are usually expressed in meters; visible light in centimeters, angstroms or microns; and X-rays and gamma rays in angstroms or millimicrons. X-ray and gamma photons are often described by specifying their energy in electron-volts.

Instrumentation on the IQSY Solar Explorer will make measurements in the X-ray and ultraviolet regions of the electromagnetic spectrum.

Radiation measurements will be obtained by two types of photometers -- ion chambers and Geiger counters. The latter will be used for measurements below eight angstroms. Ultraviolet photometers will measure the region from 1080 to 1350 A.

The satellite measurements will be as follows:

Wavelength (In angstroms)	Type of Emission	Number of Photometers	Type of Photometers
0.5 to 3	X-ray	two	Geiger counter and one backup
1 to 8	X-ray	four*	Geiger counter, 2 ion chambers and one backup for G counter
1 to 20	X-ray	one	Ion chamber
8 to 16	X-ray	two*	Two ion chambers

Wavelength (In angstroms)	Type of Emission	Number of Photometers	Type of Photometers
44 to 60	X-ray	one	Ion Chamber
1080 to 1350	Ultra-violet	two	Ion chamber (2 in parallel)
1225 to 1350	Ultra-violet	two	Ion chamber (2 in parallel)

(*--Each 1-8A and 8-16A photometer has a different degree of sensitivity to cover a broad range of flux values and to permit the correlation and extension of similar measurements on earlier satellites.)

The measurements are made in different but overlapping X-ray bands so that comparison of the different photometer outputs can be employed to construct a model of the solar X-ray spectrum and to provide an instantaneous indication of spectral changes with solar activity.

Satellite-obtained data on the daily average X-ray flux will be provided to the Institute for Telecommunications Sciences and Aeronomy, Boulder, Colorado, for rapid publication.

SCOUT LAUNCH VEHICLE

Scout is a four stage solid propellant rocket capable of carrying payloads of varying sizes on orbital, space probe or reentry missions. It is 72 feet long and weighs about 20 tons at lift-off.

Scout was developed and is managed by NASA's Langley Research Center, Hampton, Va. Prime contractor is Ling-Temco-Vought, Inc., Dallas, Texas.

Its four motors are interlocked with transition sections which contain guidance, control, ignition, instrumentation systems, separation mechanisms, and the spin motors required to stabilize the fourth stage. Guidance is provided by a strapped-down gyro system and control is achieved by a combination of aerodynamic surfaces, jet vanes and hydrogen peroxide jets.

Scout is capable of placing a 320-pound payload into a 300 nautical mile orbit or of carrying a 100-pound scientific package 18,000 miles from Earth.

Scout stages include the following motors:

First stage:	Algol 11B - 100,944 pounds thrust, burning 80 seconds.
Second stage:	Castor 1 - 63,109 pounds thrust, burning 46 seconds.
Third stage:	Antares (X-259) - 22,606 pounds thrust, burning 34.9 seconds.
Fourth stage:	Altair 11E6 (X-258) - 6,414 pounds thrust, burning 22.2 seconds.

IQSY SOLAR EXPLORER PROJECT TEAM

For the National Aeronautics and Space Administration:

M. J. Aucremanne (Headquarters) Program Manager.

J. M. Weldon (Headquarters) Program Scientist.

T. W. Perry (Wallops) Project Coordinator.

W. A. Guild (Headquarters) Scout Program Manager.

E. D. Schult (Langley) Head, Scout Project Office.

For the U. S. Naval Research Laboratory:

R. W. Kreplin, Project Scientist.

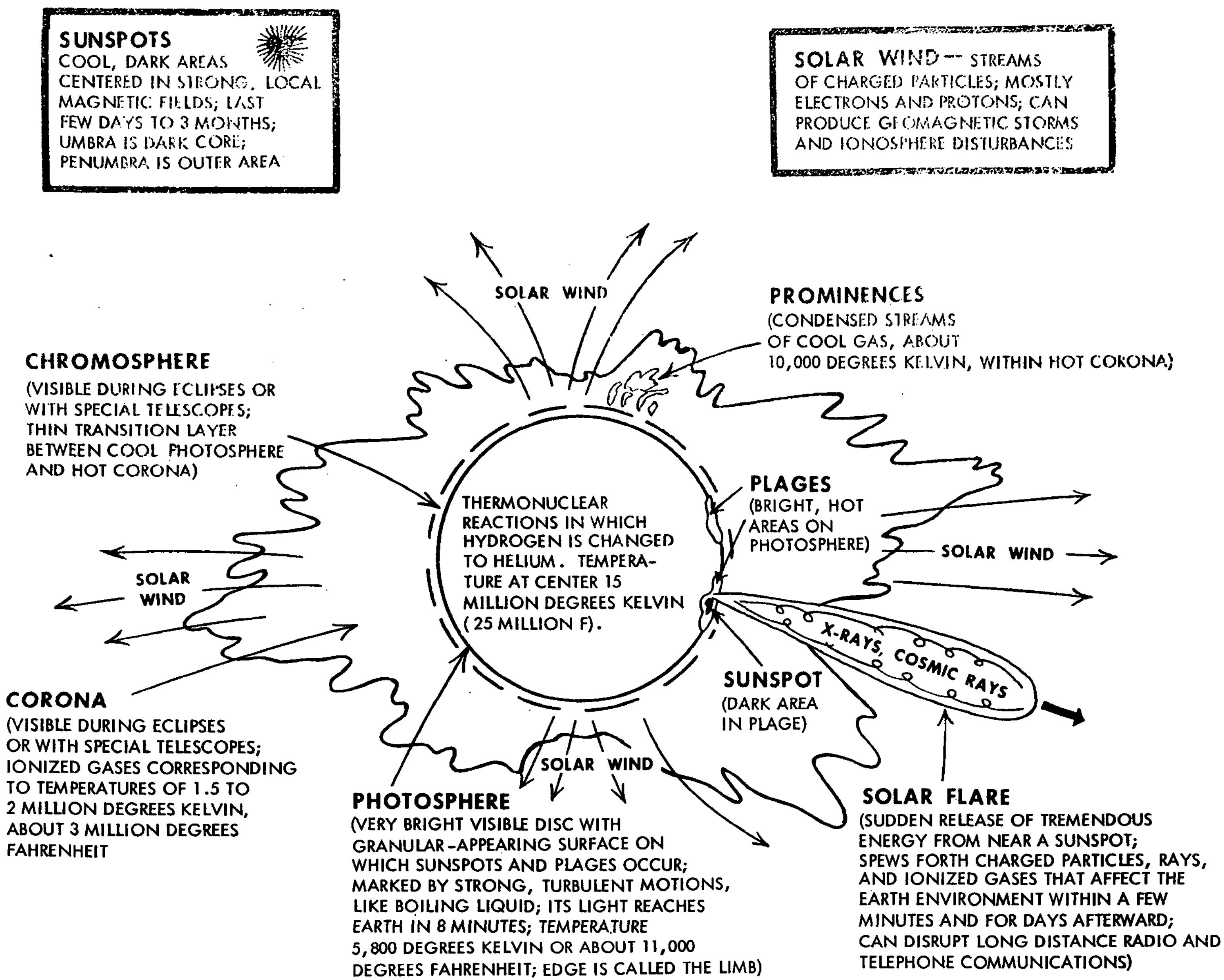
P. G. Wilhelm, Project Manager.

H. Friedman, Scientific Investigator.

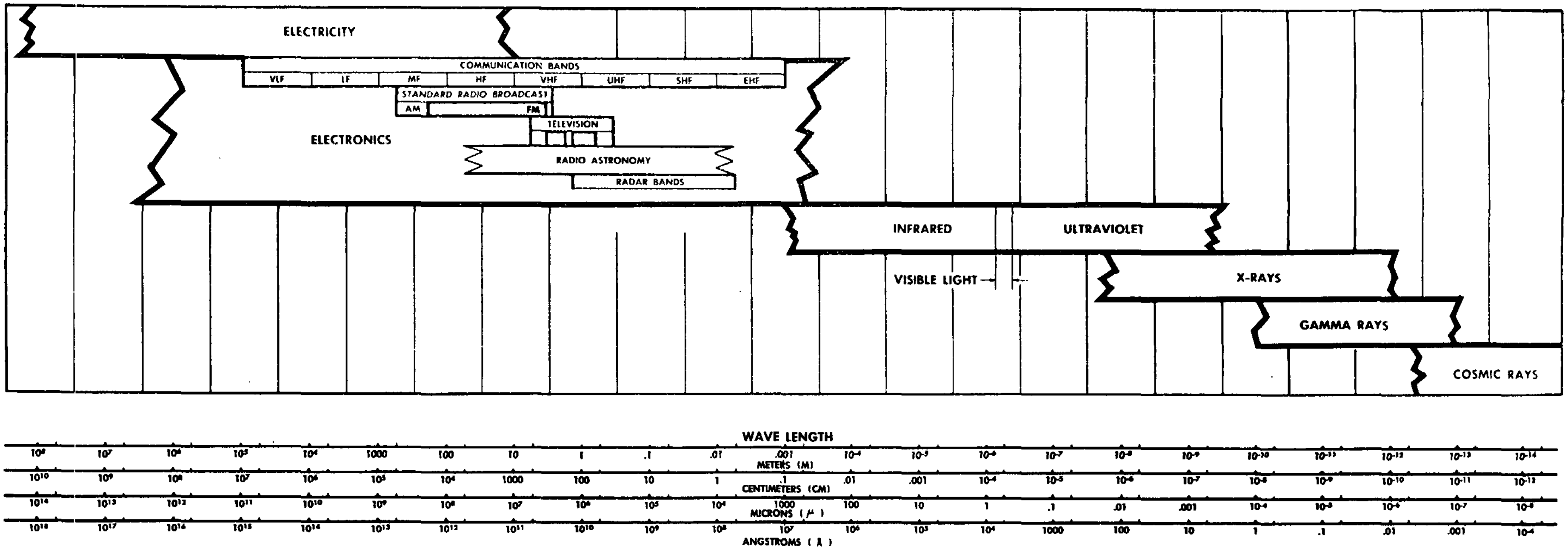
T. A. Chubb, Scientific Investigator.

-End-

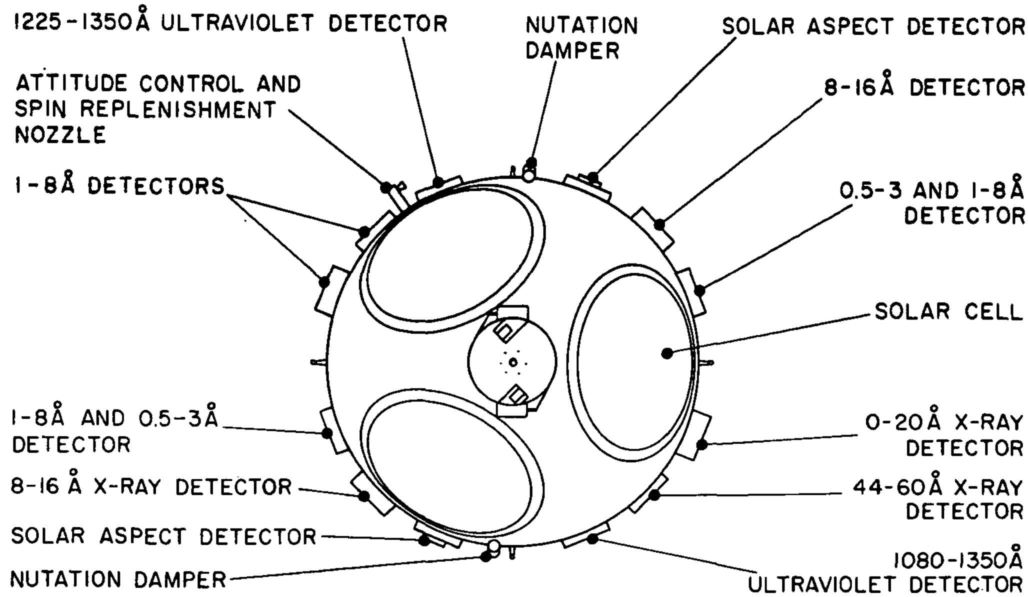
SOLAR AREAS OF SCIENTIFIC INTEREST



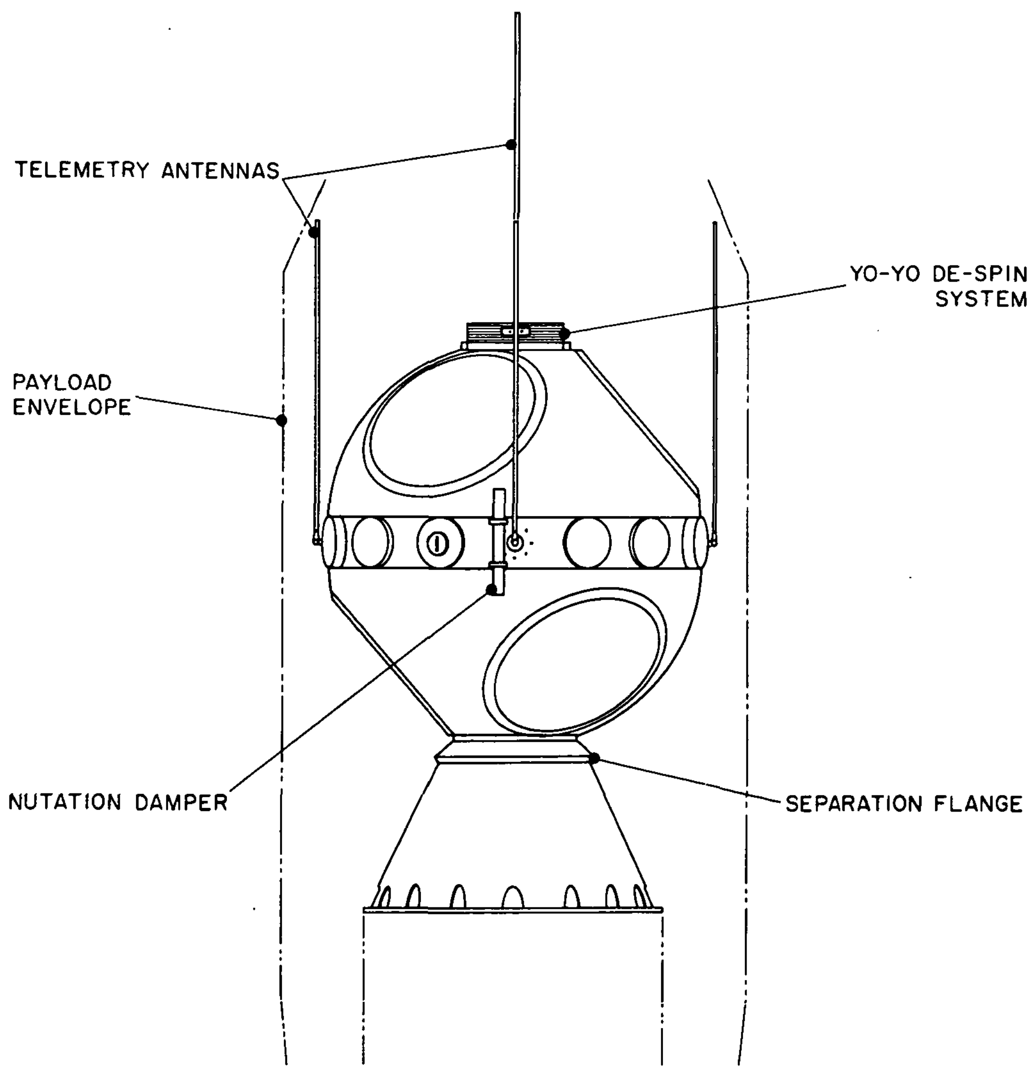
IQSY SOLAR EXPLORER REGIONS OF STUDY



Regions of solar electromagnetic spectrum to be monitored and investigated by the IQSY Solar Explorer. Regions extend from 0.5 to 16 Angstroms, 44 to 60 and 1080 to 1350.



TOP VIEW



SIDE VIEW